

**PATENT COOPERATION TREATY**

**PCT**

**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**  
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

|  |   |   |                  |
|--|---|---|------------------|
| Applicant's or agent's file reference<br>IP/7207/WOD   | <b>FOR FURTHER ACTION</b>   |   | See item 4 below |
| International application No.<br>PCT/GB2004/004722   | International filing date (day/month/year)<br>08 November 2004 (08.11.2004) | Priority date (day/month/year)<br>20 November 2003 (20.11.2003) |                  |
| International Patent Classification (8th edition unless older edition indicated)<br>See relevant information in Form PCT/ISA/237 |   |   |                  |
| Applicant<br>QINETIQ LIMITED   |   |   |                  |

|  |   |                     |                                     |          |                                      |  |                                     |                            |   |   |                                     |                         |   |  |                                       |   |
|--|---|---------------------|-------------------------------------|----------|--------------------------------------|--|-------------------------------------|----------------------------|---|---|-------------------------------------|-------------------------|---|--|---------------------------------------|---|
| <p>1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p>In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.</p>  |   |                     |                                     |          |                                      |  |                                     |                            |   |   |                                     |                         |   |  |                                       |   |
| <p>3. This report contains indications relating to the following items:</p> <table> <tr> <td><input checked="" type="checkbox"/> Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td><input type="checkbox"/> Box No. II</td> <td>Priority</td> </tr> <tr> <td><input type="checkbox"/> Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input type="checkbox"/> Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/> Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/> Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input checked="" type="checkbox"/> Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input type="checkbox"/> Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> <p>4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).</p> | <input checked="" type="checkbox"/> Box No. I   | Basis of the report | <input type="checkbox"/> Box No. II | Priority | <input type="checkbox"/> Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability | <input type="checkbox"/> Box No. IV | Lack of unity of invention | <input checked="" type="checkbox"/> Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement | <input type="checkbox"/> Box No. VI | Certain documents cited | <input checked="" type="checkbox"/> Box No. VII | Certain defects in the international application | <input type="checkbox"/> Box No. VIII | Certain observations on the international application |
| <input checked="" type="checkbox"/> Box No. I  | Basis of the report   |                     |                                     |          |                                      |  |                                     |                            |   |   |                                     |                         |   |  |                                       |   |
| <input type="checkbox"/> Box No. II  | Priority  |                     |                                     |          |                                      |  |                                     |                            |   |   |                                     |                         |   |  |                                       |   |
| <input type="checkbox"/> Box No. III   | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  |                     |                                     |          |                                      |  |                                     |                            |   |   |                                     |                         |   |  |                                       |   |
| <input type="checkbox"/> Box No. IV  | Lack of unity of invention  |                     |                                     |          |                                      |  |                                     |                            |   |   |                                     |                         |   |  |                                       |   |
| <input checked="" type="checkbox"/> Box No. V  | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |                     |                                     |          |                                      |  |                                     |                            |   |   |                                     |                         |   |  |                                       |   |
| <input type="checkbox"/> Box No. VI  | Certain documents cited   |                     |                                     |          |                                      |  |                                     |                            |   |   |                                     |                         |   |  |                                       |   |
| <input checked="" type="checkbox"/> Box No. VII  | Certain defects in the international application  |                     |                                     |          |                                      |  |                                     |                            |   |   |                                     |                         |   |  |                                       |   |
| <input type="checkbox"/> Box No. VIII  | Certain observations on the international application   |                     |                                     |          |                                      |  |                                     |                            |   |   |                                     |                         |   |  |                                       |   |

|  |   |
|--|---|
| <p>Date of issuance of this report<br/>22 May 2006 (22.05.2006)</p>  |   |
| <p>The International Bureau of WIPO<br/>34, chemin des Colombettes<br/>1211 Geneva 20, Switzerland</p> <p>Facsimile No. +41 22 740 14 35</p> | <p>Authorized officer<br/><b>Dorothée Mülhausen</b></p> <p>Telephone No. +41 22 338 87 40</p> |

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

REC'D 31 JAN 2005  
WIPO PCT

PCT

To:

see form PCT/ISA/220

## WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing  
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference  
see form PCT/ISA/220

### FOR FURTHER ACTION

See paragraph 2 below

International application No.  
PCT/GB2004/004722

International filing date (day/month/year)  
08.11.2004

Priority date (day/month/year)  
20.11.2003

International Patent Classification (IPC) or both national classification and IPC  
H01L29/778, H01L29/737, H01L27/082, H01L27/06, H01L29/10

Applicant  
QINETIQ LIMITED

#### 1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, Inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

#### 2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

#### 3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.  
PCT/GB2004/004722

**Box No. I Basis of the opinion**

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
  - This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material:
    - a sequence listing
    - table(s) related to the sequence listing
  - b. format of material:
    - in written format
    - in computer readable form
  - c. time of filing/furnishing:
    - contained in the international application as filed.
    - filed together with the international application in computer readable form.
    - furnished subsequently to this Authority for the purposes of search.
3.  In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.  
PCT/GB2004/004722

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**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or  
industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

|                               |             |          |
|-------------------------------|-------------|----------|
| Novelty (N)                   | Yes: Claims | 7,8      |
|                               | No: Claims  | 1-6,9-15 |
| Inventive step (IS)           | Yes: Claims |          |
|                               | No: Claims  | 1-15     |
| Industrial applicability (IA) | Yes: Claims | 1-15     |
|                               | No: Claims  |          |

**2. Citations and explanations**

**see separate sheet**

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**Box No. VII Certain defects in the international application**

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The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**Re Item V.**

- 1 The following documents are referred to in this communication:  
D1: US 2003/080332 A1  
D2: WO 03/081674 A  
D3: WO 01/93337 A  
D4: LOTT J A ET AL: "STRAINED P-CHANNEL INGASB/ALGASB MODULATION-DOPED FIELD-EFFECT TRANSISTORS" ELECTRONICS LETTERS, IEE STEVENAGE, GB, vol. 28, no. 15, 16 July 1992 (1992-07-16), pages 1459-1460, XP000307703 ISSN: 0013-5194  
D5: US-A-5 298 441  
D6: PATENT ABSTRACTS OF JAPAN vol. 015, no. 265 (E-1086), 5 July 1991 (1991-07-05) & JP 03 088369 A  
D7: PATENT ABSTRACTS OF JAPAN vol. 013, no. 184 (E-751), 28 April 1989 (1989-04-28) & JP 01 009656 A  
D8: EP-A-0 241 988  
D9: PATENT ABSTRACTS OF JAPAN vol. 015, no. 444 (E-1132), 12 November 1991 (1991-11-12) & JP 03 187269 A  
D10: US-A-5 241 197  
D11: CUI D ET AL: "TECHNOLOGY AND FIRST ELECTRICAL CHARACTERISTICS OF COMPLEMENTARY NPN AND PNP INALAS/INGAAS HETEROJUNCTION BIPOLAR TRANSISTORS" JAPANESE JOURNAL OF APPLIED PHYSICS, TOKYO, JP, vol. 41, no. 2B, PART 1, February 2002, pages 1124-1130, XP001192196 ISSN: 0021-4922
- 2 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1 and 15 is not new in the sense of Article 33(2) PCT.
  - 2.1 Document D1 (see Figure and corresponding description, in particular par. 40) discloses an extracting FET comprising a p channel device, a p+ layer (30); an n-  $\text{In}_{0.85}\text{Al}_{0.15}\text{Sb}$  layer (24); a low dopant concentration n or p type InSb quantum well (22); an n-  $\text{In}_{0.85}\text{Al}_{0.15}\text{Sb}$  layer (20); an n+  $\text{In}_{0.70}\text{Al}_{0.30}\text{Sb}$  (19) and an n+  $\text{In}_{0.70}\text{Al}_{0.30}\text{Sb}$  layer (18) and strain in the quantum well to raise the hole mobility. The subject-matter of claims 1 and 15 therefore lacks novelty (Art. 33(2) PCT).

2.2 D4 (see Figure 1 and associated description) discloses a p-channel modulation doped FET comprising  $In_{0.25}Ga_{0.75}Sb$  quantum well under compressive strain between AlGaSb barriers. The subject-matter of claim 1 therefore lacks novelty (Art. 33(2) PCT).

2.3 D5 (see Fig. 4 and associated description) discloses a p-channel FET, a strained InSb channel for increasing the mobility. The subject-matter of claim 1 therefore lacks novelty (Art. 33(2) PCT).

2.4 D6 (see Fig. 1-5 and abstract) discloses an n-p-n bipolar transistor comprising a narrow band gap p base (InAs over InP substrate) or InGaAs over GaAs (implicit that compressive strain is present). The subject-matter of claim 1 therefore lacks novelty.

2.5 D7 (see Fig. and abstract) discloses a strained InGaAs base for increasing the mobility and decreasing the base resistance of a base in a NPN transistor. The subject-matter of claim 1 therefore lacks novelty (Art. 33(2) PCT).

2.6 D8 (see col 5, lines 10-17; Fig. 1 and associated description) discloses a FET including a strained p-channel for increasing the mobility. The subject-matter of claim 1 therefore lacks novelty (Art. 33(2) PCT).

2.7 D9 (see abstract and Figure) discloses a strained Ge channel or base having increased mobility. The subject-matter of claim 1 therefore lacks novelty (Art. 33(2) PCT).

2.8 D10 (see Fig. 4 and associated description) discloses a stained Ge base for increasing the mobility. The subject-matter of claim 1 therefore lacks novelty (Art. 33(2) PCT).

3. CLAIMS 2-15:  
Claims 2-15 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).

Lack of novelty; Claims 2-6,9-15:

D1, D4, D5, D8, D9 and D10 disclose majority carrier transport (P channel FET). D1 discloses an extraction FET and adjacent InAlSb barrier layer causing compressive strain in the InSb quantum well. D6 discloses an InAs or InGaAs p-base. D7 discloses a strained InGaAs base. D9 and D10 disclose a strained p-Ge base. D6,D9 and D10 disclose base contacts which are suitable for reducing minority carrier injection. D10 discloses integrated and complementary devices.

Lack of inventive step (Art. 33(3) PCT); Claims 7,8,13-15

The use of primary and secondary conduction channels is generally known (see D2 , Fig. 5, 9 and associated description). A skilled person would implement the channels in the device of D1 for improving device characteristics (lack of inventive step).

Complementary circuits and integrated circuits fall within the competence of a skilled person (see e.g. D11). A skilled person would form the base of the transistor in D3 as a strained base to increase the hole mobility (as suggested in D3 (see par. 40) or in D9 (see abstract).

- 4 The subject-matter as defined in claims 1-15 is obviously susceptible of industrial application.

**Re Item VII.**

The reference to the drawings in claim 15 does not meet the requirements of Rule 6.2(a) PCT.